

Synthesis of Organics Using Metal-Silicate Grains: Implications for Protostellar Systems

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Currently, it is unknown what exact process or combination of processes produced organics that are found in meteorites or are detected in comets and nebulae. One particular process that forms organics involves Fischer-Tropsch type (FTT) reactions. Fischer-Tropsch type synthesis produces hydrocarbons by hydrogenating carbon monoxide via surface-mediated reactions. Calculations of the efficiency of FTT synthesis in the Solar Nebula suggest that these types of reactions could make significant contributions to the composition of material near three AU. We used lab-synthesized amorphous Fe- and Mg-silicate grains as the solid for these surface-mediated reactions and circulate CO, N₂, and H₂ gas through these grains at a specific temperature. It is thought that these types of grains are a suitable analog for the starting materials found in protostellar nebulae. We previously showed that this process deposits macromolecular (solvent insoluble) organic phases that when pyrolyzed bear similarity to insoluble organic fractions of Murchison. While this does not prove that such reactions are the source of meteoritic organic matter; it does provide support for the viability of the hypothesis underlying these experiments.

During this conference, we discuss the GC/MS analyses of the volatile organics produced during the reactions. We also discuss the implications these types of experiments hold for the formation of organic materials in protostellar systems.